Sun™ Trunking 1.3 Installation and User's Guide

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www.sun.com

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Preface

The *SunTrunking 1.3 Installation and User's Guide* describes how to install and configure the Sun Trunking™ 1.3 software. These instructions are designed for an experienced system administrator with networking knowledge.

How This Book Is Organized

This manual describes how to install and configure the Sun Trunking 1.3 software on the supported adapters.

Chapter 1 provides an overview of Sun Trunking 1.3 software, an overview of the Sun Trunking 1.3 software, including the hardware and software requirements for using this product.

Chapter 2 describes how to prepare for and install the Sun Trunking 1.3 software packages using the automated installation script.

Chapter 3 describes how to edit and create the Sun Trunking 1.3 configuration files.

Appendix A describes how to install the Sun Trunking 1.3 software and the driver software manually.

Using UNIX Commands

This document might not contain information on basic UNIX® commands and procedures such as shutting down the system, booting the system, and configuring devices. See the following for this information:

- Software documentation that you received with your system
- Solaris™ operating environment documentation, which is at `http://docs.sun.com`

Typographic Conventions

Typeface[1]	Meaning	Examples
`AaBbCc123`	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
`AaBbCc123`	What you type, when contrasted with on-screen computer output	`% su` `Password:`
AaBbCc123	Book titles, new words or terms, words to be emphasized. Replace command-line variables with real names or values.	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be superuser to do this. To delete a file, type `rm` *filename*.

1 The settings on your browser might differ from these settings.

Shell Prompts

Shell	Prompt
C shell	*machine-name*%
C shell superuser	*machine-name*#
Bourne shell and Korn shell	$
Bourne shell and Korn shell superuser	#

.

Related Documentation

TABLE P-1 Related Documentation

Application	Title	Part Number
Install	*Sun Quad FastEthernet SBus Adapter Installation and User's Guide*	805-0732-10
Install	*Sun Quad FastEthernet SBus Adapter Release Notes*	805-1444-13
Install	*Sun Quad FastEthernet PCI Adapter Installation and User's Guide*	805-1797-10
Install	*Sun Quad FastEthernet PCI Adapter Release Notes*	805-2901-11
Install	*Sun GigabitEthernet/S 2.0 Adapter Installation and User's Guide*	805-2784-10
Install	*Sun GigabitEthernet/S 2.0 Adapter Release Notes*	805-5937-10
Install	*Sun GigabitEthernet/P 2.0 Adapter Installation and User's Guide*	805-2785-13
Install	*Sun GigabitEthernet/P 2.0 Adapter Release Notes*	805-5938-13
Install	*Sun GigabitEthernet SBus Adapter 1.1 User's Guide*	805-1797-10
Install	*Sun GigabitEthernet SBus Adapter 1.1 Product* Notes	805-3950-10
Install	*Sun GigabitEthernet PCI Adapter 1.1 User's Guide*	805-2901-11
Install	*Sun GigabitEthernet PCI Adapter 1.1 Product Notes*	805-3952-11
Install	*Sun GigaSwift Ethernet PCI Adapter Installation and User's Guide*	816-1702-11
Install	*Sun GigaSwift Ethernet PCI Adapter Product Notes*	816-1703-10

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CHAPTER 1

Overview of Sun Trunking 1.3 Software

This chapter provides an overview of the Sun Trunking 1.3 software, including the hardware and software requirements for using this product. This chapter includes the following sections:

- "What is Sun Trunking?" on page 1
- "Hardware and Software Requirements" on page 2
- "Key Features" on page 2
- "What is New in This Release?" on page 3

What is Sun Trunking?

Sun Trunking 1.3 software provides the ability to aggregate multiple links between a pair of devices so that they work in parallel as if they were a single link. Once aggregated, these point-to-point links operate as a single highly available "fat pipe" providing increased network bandwidth as well as high availability. For a given link level connection, trunking enables you to add bandwidth up to the maximum number of network interface links supported.

Sun Trunking 1.3 provides trunking support for the following network interface cards:

- Sun Quad FastEthernet adapter
- Sun GigabitEthernet adapter
- Sun GigaSwift Ethernet adapter
- Sun Dual FastEthernet and Dual SCSI/P adapter

Sun Trunking 1.3 provides support for these adapters for Solaris 7, 8, and 9 operating environment. Refer to the product documentation for both your adapter and your version of Solaris.

Hardware and Software Requirements

Before installing the Sun Trunking 1.3 software, make sure your system meets the following hardware and software requirements:

Hardware and Software	Requirements
Hardware	Sun Ultra 60, Sun Ultra Enterprise 3x00, 4x00, 5x00, 6x00, E250, E450, Sun Enterprise 10000, 12000, 15000 Sun Fire™ 4800, Netra T3, T4, Sun Blade™ 100, 150, 1500, 2500 Netra™ T4.
Network Interface Cards and drivers	Sun Quad FastEthernet adapter (`qfe` driver), Sun GigabitEthernet adapter (`ge` driver), Sun GigaSwift Ethernet adapter (`ce` driver), Sun Dual FastEthernet and Dual SCSI/P adapter (`ce` driver)
OpenBoot PROM	Revision 3.x
Software	Solaris 7, 8, or 9 operating environment

You can use any trunking-capable switch with the Sun Trunking 1.3 software. However, the switch must first be statically configured for trunking. (Refer to your switch manual.)

CPU Requirements

Multiple trunks can be configured per server. However the total number of links aggregated depends on the server capability. As a general guideline you need a minimum of 1.25 MHz of CPU speed for every 1 Mbps of NIC bandwidth capability. For optimum performance, use 2 MHz of CPU speed for every 1 Mbps of NIC bandwidth capability. Any number of aggregations is supported within this guideline.

Key Features

Sun Trunking 1.3 software implements the following key features:

- Scalable, high density bandwidth
- Automatic link-level failover

- Load balancing based on policy: MAC address, Round Robin, IP Destination Address, or IP Source Address/IP Destination Address.
- Command line interface (CLI) backward compatibility with Sun Trunking 1.2.1
- Provides the ability to aggregate ports for the following drivers:
  - `ce`, `ge`—a maximum of four ports can be aggregated
  - `qfe`—a maximum of 16 ports can be aggregated

What is New in This Release?

- New underlying software architecture for Sun GigaSwift Ethernet adapter (`ce`) support (`ge` and `qfe` remain the same)
- Solaris 7, 8, 9 support
- Same `nettr(1M)` interface:
  - `conf` option enhanced
  - `debug` option deprecated
- Four `ge` interfaces are supported (Trunking 1.2.1 supported only two interfaces.)
- Automatic installation and removal of Trunking 1.3 software

CHAPTER 2

Installing Sun Trunking 1.3 Software

This chapter describes how to prepare for and install the Sun Trunking 1.3 software packages using the automated installation script. This chapter includes the following sections:

- "Preparing for the Software Installation" on page 5
- "Installing the Sun Trunking 1.3 Software" on page 6

Preparing for the Software Installation

Before installing the Sun Trunking 1.3 software, you should have already installed one or more of the following adapters:

- Sun Quad FastEthernet adapter
- Sun GigabitEthernet adapter
- Sun GigaSwift Ethernet adapter
- Sun Dual FastEthernet and Dual SCSI/P adapter

Refer to your product documentation for installation instructions.

Verifying Required Driver Software

You cannot activate the Sun Trunking 1.3 software until the driver software is installed.

▼ To Verify that the Software is Installed

1. **Verify the presence of the driver software:**

- If your system is booted using the 32-bit kernel:

```
# pkginfo -l package
```

  Where *package* = SUNWqfed, SUNWged, or SUNWced

- If system is booted using the 64-bit kernel:

```
# pkginfo -l package
```

Where *package* = SUNWqfedx, SUNWgedx, or SUNWcedx

SUNWqfed, SUNWqfedx (for QuadFast Ethernet)

SUNWged, SUNWgedx (for Gigabit Ethernet)

SUNWced, SUNWcedx (for GigaSwift Ethernet and Dual FastEthernet and Dual SCSI/P)

If the command responds with packaging information, the packages are installed. If the packages are not installed, refer to your product documentation.

Installing the Sun Trunking 1.3 Software

Sun Trunking 1.3 provides an automated installation script. In most cases, you can use the following procedure and execute the installation script. If you have any problems, see Appendix A for manual installation procedures.

▼ To Install the Sun Trunking 1.3 Software Packages

1. **At the system console, become superuser (root).**

2. **Change to the directory where the install script resides:**

```
# cd media_path
```

Where:

media_path = `/cdrom/cdrom0`, if you are installing from the Trunking 1.3 CD-ROM

or

unzipped Trunking_1_3_path`/Trunking_1_3`, if you are installing from a download file.

3. **Execute the install script:**

```
# ./install
```

The install script verifies that the Trunking software is current or needs to be removed before installation can begin, installs the Trunking software packages, verifies the current driver software and patch if necessary. Nothing will be installed until you are prompted to `continue`.

```
Sun Trunking 1.3 Utility Installation.

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*** Checking for existing Sun Trunking 1.3 Utility packages...

*** Checking for supporting Ethernet drivers and patches...

This script is about to take the following actions:
- Remove pre-existing Sun Trunking 1.3 Utility software

Press return to continue, or 'Q' followed by a return to quit:
```

4. **Press Return to continue the installation:**

```
*** Removing pre-existing Sun Trunking 1.3 Utility packages...

Removal of <SUNWtrku> was successful.

Removal of <SUNWtrkm> was successful.
*** Done.
Old packages have been removed, please re-execute install script

A log of this Install can be found at:
     /var/tmp/Trunking.install.2003.06.27
```

Note – If a previous version of Trunking software is found and removed, you must execute the install script again.

---

5. **Execute the install script again:**

```
# ./install
```

You will see messages similar to the following:

CODE EXAMPLE 2-1 Output from Sun Trunking Installation Script

```
*** Sun Trunking 1.3 Utility install script starting.
*** The current directory is </cdrom/cdrom0>.
*** This system is running Solaris 9.

Sun Trunking 1.3 Utility Installation.

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*** Checking for existing Sun Trunking 1.3 Utility packages...

*** Making sure that  exist under Solaris_9/Trunking/Packages...
*** Checking if Sun Trunking 1.3 Utility packages are already
installed...
*** Checking for multiple instances of the Sun Trunking 1.3 Utility
software...
*** Checking for supporting Ethernet drivers and patches...

*** Checking if Sun GigaSwift Ethernet packages are already
installed...
```

CODE EXAMPLE 2-1 Output from Sun Trunking Installation Script *(Continued)*

```
*** Checking Sun GigaSwfit Ethernet patches are already
installed...
*** Checking if Sun GigaSwift Ethernet packages are already
installed...
*** Checking Sun Vlan Ethernet Utility patch is already
installed...
*** Checking if Sun Gigabit Ethernet packages are already
installed...
*** Checking Sun Gigabit Ethernet patches are already installed...
*** Checking if Sun Quadfast Ethernet packages are already
installed...
*** Checking Sun Quadfast Ethernet patches are already
installed...
This script is about to take the following actions:
- Install Sun Trunking 1.3 Utility packages.
- Install GigaSwift Ethernet: 112817-10 required patch(es).



Press return to continue, or 'Q' followed by a return to quit:
*** Installing patch 112817-10 for Solaris 9...

Checking installed patches...
Verifying sufficient filesystem capacity (dry run method)...
Installing patch packages...

Patch number 112817-10 has been successfully installed.
See /var/sadm/patch/112817-10/log for details

Patch packages installed:
  SUNWcea
  SUNWceax
  SUNWced
  SUNWcedu
  SUNWcedx

*** Installing Sun Trunking 1.3 Utility packages...
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=========================================================
Please modify /etc/opt/SUNWconn/bin/nettr.sh to set up trunking
configuration.
Please create /etc/hostname.qfeN entries for QFE trunk heads.
Please create /etc/hostname.geN entries for GEM trunk heads.
Please create /etc/hostname.ceN entries for CE trunk heads.
Reboot your system.
```

CODE EXAMPLE 2-1 Output from Sun Trunking Installation Script *(Continued)*

```
==============================================
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*** Done.
A log of this Install can be found at:
    /var/tmp/Trunking.install.2003.07.10
```

▼ To Verify that Sun Trunking 1.3 Packages Are Installed

1. **Verify the presence of the driver:**

```
# pkginfo -l package
```

Where *package* = SUNWtrku, SUNWtrkm

If the command responds with packaging information, the packages are installed. If the packages are not installed, refer to Appendix A.

▼ To Remove the the Sun Trunking 1.3 Packages

- **As superuser, change to the directory where the trunking packages reside and remove them:**

```
# ./remove
Note, this script DOES NOT remove Network Ethernet Driver patches.
This should not be necessary.

Trunking 1.3 package removal script, please select an option:

1) Remove Sun Trunking 1.3 Software
2) Quit
Select an option: 1

application SUNWtrku       Sun Trunking Utility for Solaris 9
system      SUNWtrkm       Sun Trunking Man Pages
About to take the following actions:
- Remove Sun Trunking 1.3 Sofware
Press 'q' followed by the return key to quit, or press any other
key followed by
the return key to continue:

*** Removing packages...

Removal of <SUNWtrku> was successful.

Removal of <SUNWtrkm> was successful.
*** Done.  A log of this removal can be found at:
        /var/tmp/Trunking.remove.2003.06.27
```

CHAPTER 3

Configuring the Sun Trunking 1.3 Software

This chapter describes how to edit and create the Sun Trunking 1.3 configuration files. This chapter includes the following sections:

- "Preparing for Trunking Configuration" on page 13
- "Configuring Trunking with the `nettr` Utility" on page 28
- "Load Balancing Methods" on page 31
- "Interoperability" on page 33
- "Troubleshooting" on page 36

Preparing for Trunking Configuration

Before rebooting your system, you must edit and create configuration files to define how you will link the Ethernet network interfaces. To configure these files, you need to know the following for each Ethernet adapter:

- The device instance numbers of each Ethernet network interface.
- The device instance number for the trunk head.
- The trunking policy you want to use: MAC, Round Robin, IP Destination, or IP Source/IP Destination. (See "Trunking Policies" on page 31.)

Checking for Link Mode

Always check to be sure the link mode is set to run full-duplex.

Use the `kstats` (See the `kstats` manual page: `kstats(1M)`) or the `ndd` command to verify link mode. If the information returned indicates that your trunking device is not running at full-duplex, refer your networking device product documentation for information on setting the link mode.

Booting from the Network

Once you have installed the trunking software and connected the Ethernet interfaces to a switch that is configured for trunking, you cannot use that interface to boot from the network.

Determining Instance Numbers

Each Ethernet adapter has a network interface. You will need to know the device instance numbers for each network interface before you can configure the Sun Trunking software files.

You can find the instance numbers by searching the `/etc/path_to_inst` file.

Both files contain the physical name, the instance number, and driver name for each device on the system. By searching this file, you can find the instance numbers that will be used with the Sun Trunking 1.3 software.

Note – The following examples are for a GigaSwift Ethernet adapter. If you are using a different adapter, the output will be similar. For user input, replace `ce` with `qfe` for the Quad FastEthernet adapter or `ge` for the Gigabit Ethernet adapter. The Dual FastEthernet and Dual SCSI adapter uses the `ce` driver.

Using the `grep` command, search the `path_to_inst` file for all of the devices on your system:

```
# grep ce /etc/path_to_inst
"/pci@1f,4000/network@2" 0 "ce"
"/pci@1f,4000/network@4" 1 "ce"
```

In the example above, instances `0` and `1` are GigaSwift Ethernet adapters. Your information will be similar if you are using a different adapter. TABLE 3-1 lists the network interface number, physical name, and instance number for each GigaSwift Ethernet instance on this example system.

TABLE 3-1 Example GigaSwift Ethernet Instance Numbers

Network Interface Number	Device Name	Instance Number
0	/pci@1f,4000/network@2	0
1	/pci@1f,4000/network@4	1

You will need to know the instance numbers of the GigaSwift Ethernet network interfaces in order to configure the Sun Trunking software.

Note – You cannot trunk an interface that is already plumbed. To display a list of all plumbed interfaces, execute `ifconfig -a` command.

▼ To Resolve the Problem of Plumbed Interfaces

1. **Before trunking ensure that the links are available**:

```
proboscis#  ifconfig -a
lo0: flags=1000849<UP,LOOPBACK,RUNNING,MULTICAST,IPv4> mtu 8232
index 1
         inet 127.0.0.1 netmask ff000000
eri0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500
index 2
         inet 10.4.127.55 netmask ffffff00 broadcast 10.4.127.255
         ether 0:3:ba:b:43:7b
ce0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500
index 942
        inet 199.99.10.10 netmask ffffff00 broadcast 199.99.10.255
         ether 8:0:20:bc:d6:fa
```

The output from the `ifconfig -a` command in the previous example shows that `ce0` is already plumbed, and therefore, cannot be aggregated.

2. **Unplumb the the interface as follows:**

```
proboscis# ifconfig ce0 unplumb
proboscis# ifconfig -a
lo0: flags=1000849<UP,LOOPBACK,RUNNING,MULTICAST,IPv4> mtu 8232
index 1
         inet 127.0.0.1 netmask ff000000
eri0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500
index 2
         inet 10.4.127.55 netmask ffffff00 broadcast 10.4.127.255
         ether 0:3:ba:b:43:7b
```

3. **Setup the trunk and plumb the interface:**

```
proboscis# nettr -setup 0 device=ce members=0,1,2,3 policy=2
ce trunk members:
     ce0 (head)
     ce1
     ce2
     ce3
proboscis# ifconfig ce0 plumb 199.99.10.10 up
```

Accessing Trunk Members

Trunk members can be accessed only through the trunk head. Since trunking appears to the system as a single “fat pipe,” the trunk head is the single access point. Other links in an aggregation are not plumbed beneath TCP/IP and are not visible. Networking commands such as `ifconfig(1M)` and `netstat(1M)` work only on the head instance.

For `qfe` and `ge`, you cannot do a DLPI attach on a non-head member. The following error message was returned for a `snoop` command for a non-head member:

```
# snoop -d ge1
dlattachreq:  DL_ERROR_ACK:  dl_errno 8 unix_errno 0
```

In this example, ge1 is a member of a trunk. The trunk head for that trunk is ge0. To use the snoop command, for example, in such a case, the following would be the correct usage:

```
# snoop -d ge0
Using device /dev/ge (promiscuous mode)
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
        ? -> (multicast)  ETHER Type=0C34 (Unknown), size = 52 bytes
```

Note – If you are using the ce driver, you can run snoop command on all trunk member instances.

Maximum Number of Links for Each Adapter

TABLE 3-2 shows a matrix of supported drivers and the maximum number of supported links for each:

TABLE 3-2 Matrix of Supported Drivers and Number of Links

Driver	Supported Links
qfe	16 links
ge	4 links
ce	4 links

The two network interfaces of the GigaSwift Ethernet (ce) adapter can be linked as follows.

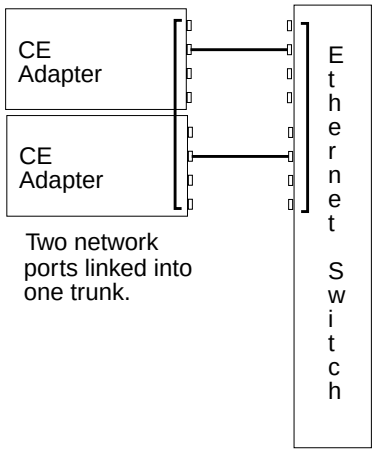

FIGURE 3-1 GigaSwift Ethernet Trunking Network Configuration Example

The two network ports of the GigabitEthernet (`ge`) adapter can be linked as follows.

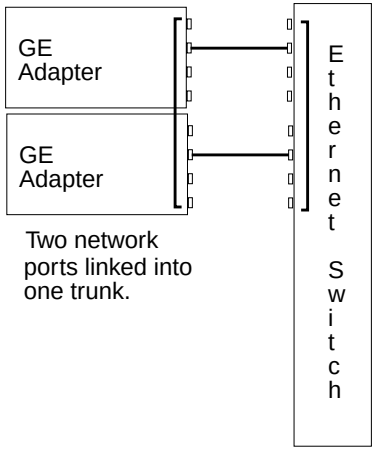

FIGURE 3-2 GigabitEthernet Trunking Network Configuration Example

The four network ports of the Quad FastEthernet (`qfe`) adapter can be linked in a number of ways, depending on the needs of your network. All four of the network ports can be linked into one trunk, or two network ports can be linked into one trunk. FIGURE 3-3 shows four different common linking possibilities.

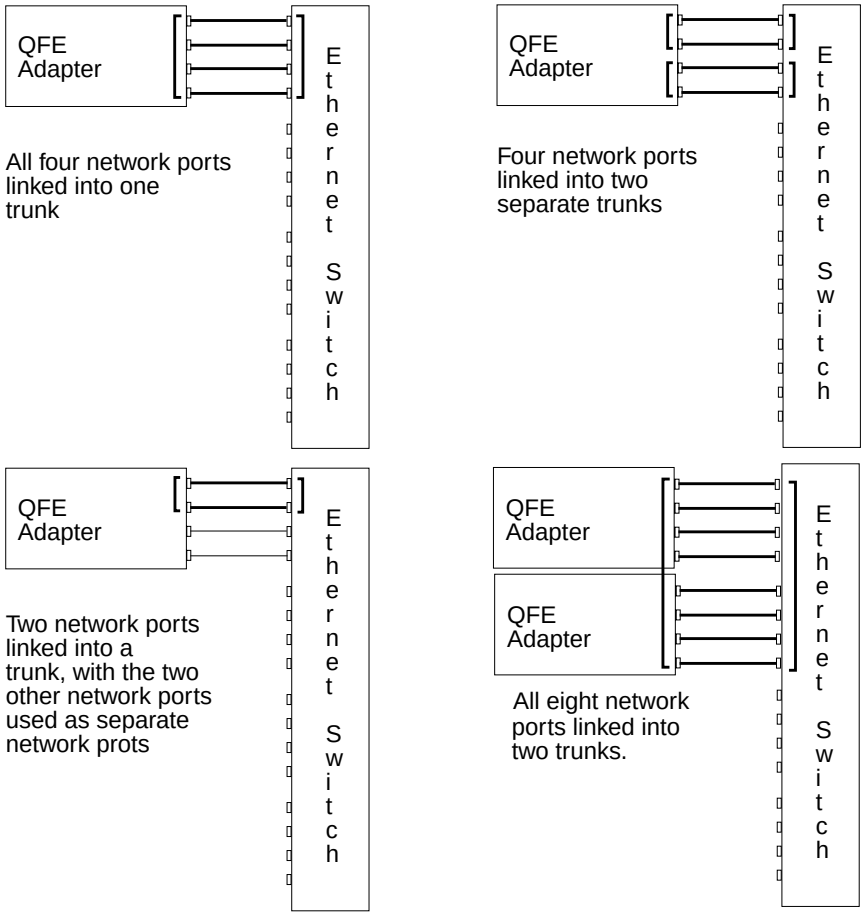

FIGURE 3-3 Quad FastEthernet Trunking Network Configuration Examples

The configuration of the Sun Trunking 1.3 software files depends on how you want to organize the Ethernet network. You must also configure the Ethernet switch software to be symmetrical with how you configured the Sun Trunking 1.3 software. Refer to your Ethernet switch documentation for the switch configuration instructions.

`local-mac-address?` Property

Each Ethernet adapter has been assigned a unique Media Access Control (MAC) address, which represents the 48-bit Ethernet address for that network interface. Each host system also provides a single global MAC address. For historical reasons,

the default MAC address for each interface is that of the single global host MAC address rather than the MAC address of each individual Ethernet adapter. This must be modified for trunking.The OpenBoot firmware has a settable `local-mac-address` property.

The `mac-address` property of the network device specifies the network address (system-wide or `local-mac-address?`) used for booting the system. To start using the MAC addresses assigned to the network interface of the Ethernet adapter, set the NVRAM configuration variable `local-mac-address?` to `true`.

```
ok setenv local-mac-address? true
```

Client machines with multiple interfaces that communicate with the trunked machine should also set `local-mac-address?` to `true`.

Using Trunking Auto-configuration Setup at Boot Time

After locating the instance numbers of the Ethernet network interfaces, and deciding how you want to organize your network, you can begin to configure the Sun Trunking 1.3 software.

▼ To Edit the `nettr.sh` File

This section describes the minimum set of instructions to configure trunking. For more details, see “Configuring Trunking with the `nettr` Utility” on page 28.

The main configuration file of the Sun Trunking 1.3 software is the `/etc/opt/SUNWconn/bin/nettr.sh` file. You will define each trunk by adding commands to this file. Before you edit the `nettr.sh` file, you need to know how many Ethernet network interfaces you want to link into a trunk, the first instance number of each trunk (also called the “trunk head”), and the trunking policy you want to use.

- **Using a text editor, add commands to the `nettr.sh` file to define your trunking network.**

In the `nettr.sh` file, add the following nettr command to configure a trunk.The format of this command is:

```
nettr -setup head-instance device=<qfe | ce | ge>
                                  members=<instance,instance,.,.>
                                   [ policy=<number> ]
```

In the command above, the head instance along with the device name is the trunk identification. The device represents the adapter type (`qfe` for a Quad FastEthernet adapter or `ce` for GigaSwift Ethernet adapter, or `ge` for Gigabit Ethernet). The member option is used to select members of a trunk. The `policy` option can either be the default value of 1 for MAC or 2 for round robin, 3 for IP Destination, or 4 for IP Source/IP Destination.

Note – The examples below use the instance numbers found in TABLE 3-1 on page 15. *The instance numbers on your system will be different*. See "Determining Instance Numbers" on page 14 for more information.

- If you want to use the MAC trunking policy and 2 links for a trunk, you need to add the following line to the `nettr.sh` file:

```
nettr -setup 0 device=ce members=0,1 policy=1
```

- Check the output that results from executing the `nettr -conf` command after executing `nettr -setup` commands.

It will be similar to the following:

```
# nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr   Speed   Duplex    Link

 ce0   ce0          1         pci    8:0:20:8f:be:24      1000    Full      Up
 ce1   ce0                    pci    8:0:20:8f:ce:15      1000    Full      Up
```

- For two trunks, containing two network interfaces each using the MAC policy, you would add these two lines:

```
nettr -setup 0 device=ce members=0,1 policy=1
nettr -setup 0 device=ce members=2,3 policy=1
```

Note – The command syntax of Sun Trunking 1.3 is is fully compatible with Trunking 1.2.1. Existing nettr.sh files do not need any modifications.

- To verify whether you have set up the trunking configuration file correctly, run the `nettr -run` command. You should see information similar to the following:

```
# nettr -run
Configuring Sun Trunking devices

ce trunk members:
    ce0 (head)
    ce1

ce trunk members:
    ce2 (head)
    ce3
```

- Execute the `nettr -conf` command to check the configuration.

```
# nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr   Speed   Duplex    Link

 ce0   ce0          1         pci    8:0:20:8f:be:24      1000    Full      Up
 ce1   ce0                   pci    8:0:20:8f:ce:15      1000    Full      Up

 ce2   ce0          1         pci    8:0:20:8f:d2:11      1000    Full      Up
 ce3   ce0                   pci    8:0:20:8f:ac:19      1000    Full      Up
```

▼ To Configure the Host Files

Before you can use these trunked Ethernet network interfaces, you must create an `/etc/hostname.`*driver#* file.

Where *driver* = `ce` for GigaSwift Ethernet, `ge` for Gigabit Ethernet, or `qfe` for Quad FastEthernet

= instance number

Then add an entry in the `/etc/hosts` file for each trunk.

1. **For each trunk, create a `/etc/hostname.ce#` file, where # corresponds to the instance number used as the trunk head.**

   For example, if you had two trunks using two network interfaces each, you would have to create two files containing the host name of the trunk as seen by network. The extensions of these files would have to correspond with the trunk head interface numbers of the trunks.

TABLE 3-3 Example `hostname.ce#` Files

Filename	Trunk Head Instance Number	GigaSwift Ethernet Adapter Network Interfaces Used in the Trunk[1]
`/etc/hostname.ce0`	0	0, 1
`/etc/hostname.ce2`	2	2, 3

[1] See FIGURE 3-1 on page 18 for more information.

   - The `/etc/hostname.ce#` file must contain an appropriate host name for the trunk.
   - The host name should be different from any other host name of any other interface, for example: `/etc/hostname.ce0` and `/etc/hostname.ce2` cannot share the same host name.

- The host name should have an IP address that is entered in the `/etc/hosts` file (see Step 2).

Using the example trunk head instance numbers in TABLE 3-3, the following example shows the three `/etc/hostname.`*device#* files required for a system called `proboscis`, which has an onboard `hme` device (`proboscis`), and two trunks (`proboscis-11`, `proboscis-12`).

```
# cat /etc/hostname.hme0
proboscis
# cat /etc/hostname.ce0
proboscis-11
# cat /etc/hostname.ce2
proboscis-12
```

Note – Only trunk *heads* are visible.

2. **Create an appropriate entry in the `/etc/hosts` file for each trunk.**

Using the example from Step 1, you would have:

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1     localhost
129.144.10.57 proboscis      loghost
129.144.11.83 proboscis-11
129.144.12.41 proboscis-12
```

Note – Make sure you configure the switch software to be symmetrical with the Sun Trunking 1.3 software. Refer to your Ethernet switch documentation for instructions.

▼ To Activate the Networks Without Rebooting

- **Setup the** `ce` **adapter using the** `ifconfig` **command, where** *ip_address* **corresponds to the system IP address.**

```
# ifconfig ce0 plumb
# ifconfig ce0 ip_address up
```

Create an entry in the `/etc/hosts` file for each active `ce` interface.

The following example shows the `/etc/hosts` file.

```
# cat /etc/hosts
#
# Internet host table
#
127.0.0.1     localhost
129.144.10.57 proboscis loghost
129.144.11.83 proboscis-11
```

Note – Make sure you configure the switch software to be symmetrical with the Sun Trunking 1.3 software. Refer to your Ethernet switch documentation for instructions.

▼ To Reboot and Activate the Trunked Networks

If you do not use `ifconfig`, you will need to reboot your system to make these trunked networks active. If you did use the previous `ifconfig` instructions, you can ignore this section.

1. **Shut down your system.**

```
# sync
# init 0
Shutdown messages.
```

2. **Set** `local-mac-address?` **to** `true`**.**

```
ok setenv local-mac-address? true
```

3. **Perform a reconfiguration boot.**

```
ok boot -r
```

Verifying the Autoconfiguration Setup

You can verify trunking networks using the `ifconfig` and the `nettr` commands.

Use the `ifconfig -a` command to print out the addressing information for each interface on the system.

```
# /usr/sbin/ifconfig -a
lo0: flags=849<UP,LOOPBACK,RUNNING,MULTICAST> mtu 8232
        inet 127.0.0.1 netmask ff000000
hme0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
        inet 129.144.131.27 netmask ffffff00 broadcast
129.144.131.255
        ether 8:0:20:8f:bf:79
ce0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
        inet 199.100.2.10 netmask ffffff00 broadcast 199.100.2.255
        ether 8:0:20:8d:2f:ff
```

Even though a trunk may be composed of two linked GigaSwift Ethernet network interfaces, the `ifconfig -a` command will only print out the addressing information for the trunk head interfaces (`ce0` in the example above).

For a more complete listing of the `ce` devices, use the `nettr -conf` command. This command prints out a list of the trunked `ce` instances on the system.

```
# /etc/opt/SUNWconn/bin/nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr   Speed   Duplex    Link

 ce0   ce0          1         pci    8:0:20:8f:be:24      1000    Full      Up
 ce1   ce0                    pci    8:0:20:8f:ce:15      1000    Full      Up
```

In the example above, the `ce0` interface is the trunk head for a two network interface trunk, composed of the `ce0`, and `ce1` interfaces. The `nettr -conf` command will also show the policy of each trunk on the system, as well as listing the original MAC address of each interface.

Use the `nettr -stat` *trunkhead* `device=`*device* command to monitor the network statistics of each interface on the system.

Where:

trunkhead is the trunk head interface number of the trunk you want to monitor

device is `qfe`, `ge`, *or* `ce`

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ce
Mar 30 15:26:58 2003

Name   Ipkts    Ierrs  Opkts  Oerrs  Collis  Crc   %Ipkts %Opkts

ce0   66518099   0     67498218    0     0      0    50.00   50.00
ce1   66527490   0     67498218    0     0      0    50.00   50.00
```

This command will list each interface and the network performance statistics, of the specified trunk. See “Configuring Trunking with the `nettr` Utility” on page 28 for more information.

You can also monitor the network statistics of a trunk at regular intervals. The full usage of the command is `nettr -stats` *trunkhead device=[ce|ge|qfe] interval=sec*, with *sec* being the number of seconds between monitoring the trunk’s interfaces. In the example below, the trunk is monitored once every second.

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ce interval=1
Mar 30 15:26:58 2003

Name   Ipkts    Ierrs  Opkts  Oerrs  Collis  Crc   %Ipkts %Opkts

ce0   66518099   0     67498218    0     0      0    50.00   50.00
ce1   66527490   0     67498218    0     0      0    50.00   50.00
```

You can also use the `netstat(1M)`or `kstat(1M)` command to monitor the network statistics. Refer to the `netstat(1M)` and `kstat(1M)` `man` pages for more information.

Disabling the Sun Trunking Interface

To permanently disable the trunking interface, comment out the `nettr` command in the `/etc/opt/SUNWconn/bin/nettr.sh` file. You will need to reconfigure the `/etc/hostname.ce#` and `/etc/hosts` files if you want to use the Ethernet network interfaces separately. Refer to the product documentation for more information.

Configuring Trunking with the `nettr` Utility

The `nettr(1M)` utility can be used to configure trunking. `nettr(1M)`can be used to:

- set up a trunk
- release a trunk
- display a trunk configuration
- display statistics fo trunked interfaces

Command Syntax

Following is the command syntax for `nettr`.

```
nettr -setup head-instance device=<qfe | ge | ce>
    members=<instance,instance,.,.>  [ policy=<number> ]
nettr -stats head-instance device=<qfe | ge | ce>
       [ interval=<time> ] [ type=<number> ]
nettr -release head-instance device=<qfe | ge | ce>
nettr -conf
nettr -run
nettr -policy
nettr -hash head-instance device=<qfe | ge | ce>
    {[ mac=<dest_mac_address> ] [ ip=<dest_ip_address> ]
       [ ip=<source_ip_address/dest_ip_address> ]}
```

Enabling Sun Trunking Interface

The format of this command is:

```
nettr -setup head-instance device=<qfe | ge | ce>
    members=<instance,instance,.,.>  [ policy=<number> ]
```

In the command above, the head instance is the instance number of the first linked network interface of the trunk. The device represents the adapter type (`qfe` for a Quad FastEthernet adapter or `ge` for GigabitEthernet adapter). The member option is used to select members of a trunk. The `policy` option can either be the default

value of 1 for MAC or 2 for round robin, 3 for IP Destination, or 4 for IP Source/IP Destination. If you wanted to use the MAC trunking policy and 2 links for a trunk, execute the following line:

```
nettr -setup 0 device=ge members=0,1 policy=1
```

Verifying the Sun Trunking Interfaces

You can verify trunking networks using the `ifconfig` and the `nettr` commands.

Use the `ifconfig -a` command to print out the addressing information for each interface on the system.

```
# /usr/sbin/ifconfig -a
lo0: flags=849<UP,LOOPBACK,RUNNING,MULTICAST> mtu 8232
        inet 127.0.0.1 netmask ff000000
hme0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
        inet 129.144.131.27 netmask ffffff00 broadcast
129.144.131.255
        ether 8:0:20:8f:bf:79
ce0: flags=863<UP,BROADCAST,NOTRAILERS,RUNNING,MULTICAST> mtu 1500
        inet 199.100.2.10 netmask ffffff00 broadcast 199.100.2.255
        ether 8:0:20:8d:2f:ff
```

Even though a trunk may be composed of two linked GigaSwift Ethernet network interfaces, the `ifconfig -a` command will only print out the addressing information for the trunk head interfaces (`ce0` in the example above).

Use the `nettr -conf` command to print out a list of trunked `ce` instances on the system.

```
# /etc/opt/SUNWconn/bin/nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr   Speed   Duplex    Link

 ce0   ce0          1         pci    8:0:20:8f:be:24      1000    Full      Up
 ce1   ce0                    pci    8:0:20:8f:be:24      1000    Full      Up
```

In the example above, the `ce0` interface is the trunk head for a two network interface trunk, composed of the `ce0`, and `ce1` interfaces. The `nettr -conf` command will also show the policy of each trunk on the system, as well as listing the original MAC address of each interface.

Use the `nettr -stat` *trunkhead* `device=`*device* command to monitor the network statistics of each interface on the system.

Where:

trunkhead is the trunk head interface number of the trunk you want to monitor

device is `qfe`, `ge`, *or* `ce`

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ce
Mar 30 15:26:58 2003

Name   Ipkts    Ierrs  Opkts  Oerrs  Collis  Crc   %Ipkts %Opkts

ce0   66518099   0     67498218    0     0      0    50.00   50.00
ce1   66527490   0     67498218    0     0      0    50.00   50.00
```

This command will list each interface and the network performance statistics, summarized in TABLE 3-4, of the specified trunk.

TABLE 3-4 Output of the `nettr -stats` Command

Network Statistic	Definition
`Ipkts`	The number of Ethernet packets inputted into the interface.
`Ierrs`	The number of errors that occurred while inputting these Ethernet packages.
`Opkts`	The number of Ethernet packets outputted through the interface.
`Oerrs`	The number of errors that occurred while outputting these Ethernet packages.
`Collis`	The number of collisions detected on the interface.
`Crc`	The number of cyclic redundancy check (CRC) errors detected on the interface.
`%Ipkts`	The percent of Ethernet packets input to the interface.
`%Opkts`	The percent of Ethernet packets output through the interface.

You can also monitor the network statistics of a trunk at regular intervals. The full usage of the command is `nettr -stats` *trunkhead device=[ce|ge|qfe] interval=sec*, with *sec* being the number of seconds between monitoring the trunk's interfaces. In the example below, the trunk is monitored once every second.

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ce interval=1
Mar 30 15:26:58 2003

Name   Ipkts    Ierrs  Opkts  Oerrs  Collis  Crc   %Ipkts %Opkts

ce0   66518099   0     67498218    0     0      0    50.00   50.00
ce1   66527490   0     67498218    0     0      0    50.00   50.00
```

You can also use the `netstat(1M)`or `kstat(1M)` command to monitor the network statistics. Refer to the `netstat(1M)` and `kstat(1M)` `man` pages for more information.

Disabling the Sun Trunking Interface

If you need to disable a trunk, use the `nettr -release` *trunkhead* command, with *trunkhead* being the trunk head interface number of the trunk you want to disable.

```
# /etc/opt/SUNWconn/bin/nettr -release 0 device=ce
```

`nettr` automatically unplumbs IPv4 and IPv6 stacks. If any other application (such as VLAN) are plumbed, remember to manually unplumb the application.

Load Balancing Methods

Trunking Policies

The four supported trunking policies used in the Sun Trunking 1.3 software are MAC, Round Robin, IP Destination, and IP Source+Destination. With these policies, if a link fails, the traffic failsover to the next available link. The policies are defined below.

MAC

- Is the default policy used by the Sun Trunking 1.3 software. MAC is the preferred policy to use with switches. Most trunking-capable switches require using the MAC-hashing policy, but check your switch documentation.
- Uses the last three bits of the MAC address of both the source and destination. For two ports, the MAC address of the source and destination are first XORed: Result = 00, 01, which selects the port.
- Favors a large population of clients. For example, this ensures that 50 percent of the client connections will go through one of two ports in a two-port trunk.
- Is required by most trunking-capable switches.

Note – Do not use MAC-hashing for connecting two servers back to back.

Round Robin

- Round Robin is the preferred policy with a Back to Back connection, used between the output of a transmitting device, and the input of an associated receiving device.
- Uses each network interface of the trunk in turn, as a method of distributing packets over the assigned number of trunking interfaces.
- May have an impact on performance since the temporal ordering of packets is not observed.

IP Destination Address

- Uses the four bytes of the IP Destination address to determine the transmission path.
- If a trunking interface host has one IP source address, and it is necessary to communicate to multiple IP clients connected to the same router, then the IP Destination Address policy is the preferred policy to use.

IP Source Address/IP Destination Address

- Connects the source server to the destination, based on where the connection originated or terminated.
- Uses the four bytes of the source and destination IP addresses to determine the transmission path.

  The primary use of the IP Source/IP Destination Address policy occurs where you use the IP virtual address feature to give multiple IP addresses to a single physical interface. For example, you might have a cluster of servers providing network services, in which each service is associated with a virtual IP address

over a given interface. If a service associated with an interface fails, the virtual IP address migrates to a physical interface on a different machine in the cluster. In such an arrangement, the IP Source Address/IP Destination Address policy gives you a greater chance of using more, different links within the trunk than would the IP Destination Address policy.

The `-hash` option to the `nettr` (`1M`) command enables you to determine over which link a given packet will travel. The following section describes hashing in greater detail.

Note – Sun Trunking 1.3, like any server trunking software, load balances the outgoing traffic, not the incoming packets. Trunking 1.3 software relies on the link partner (switch or server) to load balance the incoming packets.

▼ To Use the Hashing Feature

Note – Trunking interfaces must be set up prior to using hashing features. If, for example, on one trunk, the link to transmit is 0, with the following hash command input, the policy IP Source and Destination Address would read as follows:

```
# /etc/opt/SUNWconn/bin/nettr -hash 0 device=ce ip=
199.100.1.29/199.100.1.3

Name  Head  Policy  Source Address  Dest Address  Link to Transmit
ce0   ce0   4    199.100.1.29      199.100.1.3     0
```

The `-hash` option to the `nettr` (`1M`) command enables you to determine over which link a given packet will travel. For example, if you use the Destination IP Address policy, you can supply an IP address to a `nettr -hash` command to determine over which link a packet with the specified IP address will travel.

Interoperability

Sun Trunking 1.3 operates as a virtual network adapter that is visible to the system through the head instance. Applications will transparently work as though on a single link, yet will experience the benefits of increased bandwidth and automatic

failover. On applications that deal with a physical NIC, such as DR, you must simply unaggregate prior to performing those functions, then reaggregate when you are finished.

IEEE 802.3ad Link Aggregation

Sun Trunking 1.3 works in the static mode with 802.3ad switches. For a link to be part of an aggregation it has to be running at full-duplex and at the same speed. The endpoints of the links must be terminated at the same switch or system.

Note – Sun Trunking 1.3 does not support the LACP and Marker protocols.

IP Multipathing

IP Multipathing (IPMP) works transparently with Sun Trunking 1.3. Configure two aggregations (two trunk-heads) and group these two aggregations into one IPMP group.

Note – IPMP failover may not happen if one of the links in an aggregation fails because Sun Trunking 1.3 software will failover to the next available link in the aggregation.

Dynamic Reconfiguration

Dynamic Reconfiguration (DR) works transparently with Sun Trunking 1.3. Here is how it works:

- Unconfigure the aggregation, using `nettr -release`.
- Unconfigure the Ethernet adapter, using `cfgadm`.
- Change the Ethernet adapter.
- Configure the Ethernet adapter, using `cfgadm`.
- Reconfigure the aggregation, using `nettr -setup`.

VLAN

Sun Trunking 1.3 works transparently with 802.1q and is available only on the GigaSwift Ethernet adapter. For more information on configuring VLANs, refer to "Configuring VLANs," in the *Sun GigaSwift Ethernet Adapter Installation and User's Guide*, part number 816-1702-11.

When configuring VLANs on an aggregatation(trunk), make sure that the link partner (or switch) has VLAN enabled on all its ports belonging this aggregation.

SunVTS Diagnostic Software

The SunVTS software executes multiple diagnostic hardware tests and is used to verify the configuration and functionality of most hardware controllers and devices.

Since trunking aggregates many network adapters behind a single head instance, these tests may not provide the information intended. Unaggregate all trunking interfaces to be tested before running SunVTS.

If you still want to use the SunVTS `nettest` option on an aggregated link, use the Round Robin policy option and then use the `nettr -stats` option to ensure that test traffic is flowing over all interfaces in the aggregation.

Note – To use the `nettest` diagnostic, you must have the SunVTS software installed on your system. Refer to the *Solaris Sun Hardware Platform Guide*, which was shipped with the *Solaris Supplement* CD, for instructions on how to install the SunVTS software.

Caution – Do not run the SunVTS `netlbtest` when links are aggregated. This test will not make sense on aggregated links because the packets are distributed to multiple links based on the load balancing policy.

Performance Tuning

Refer to the Solaris operating environment user documentation for more information.

- For maximum performance, network traffic should be evenly distributed across the aggregation. Use `nettr -stats` command to ensure that packets are being evenly distributed. See “Load Balancing Methods” on page 31 for a full description of load balancing policies.
- To get better performance from `ge` or `ce` running at 1000Mbps, install each adapter in different PCI or Sbus slot. Note that some slots utilize the same PCI bus. Refer to your system documentation for more information.
- For optimum performance, use 2 MHz of CPU speed for every 1 Mbps of NIC bandwidth capability. Any number of aggregations is supported within this guideline.
- For better performance from a GigaSwift Ethernet card (ce) add the following to the driver configuration file `ce.conf` under `/platform/sun4u/kernel/drv`:

```
interrupts=1;
```

- To get better throughput over the TCP/IP stack, execute the following at the command line:

```
# ndd -set /dev/tcp tcp_xmit_hiwat 65536
# ndd -set /dev/tcp tcp_recv_hiwat 65536
# ndd -set /dev/tcp tcp_maxpsz_multiplier 10
```

Troubleshooting

If you have problems with Sun Trunking 1.3, use the following commands to gather information that may help resolve the problems.

Using the stats Option

Use the nettr -stats command to check whether network packets are showing in each trunk instance. In the following example, 1 represents the trunk head instance being monitored.

```
# /etc/opt/SUNWconn/bin/nettr -stats 0 device=ce
Mar 30 15:26:58 2003

Name   Ipkts   Ierrs    Opkts  Oerrs  Collis  Crc   %Ipkts  %Opkts

ce0   66518099    0   67498218    0     0      0      50.00  50.00
ce1   66527490    0   67498218    0     0      0      50.00  50.00
```

If you use MAC policy, you may not see packets on certain interfaces, as shown in the example. This occurs because two or more clients may have MAC addresses with the last two bits identical. See “Trunking Policies” on page 31 for more information.

Using the snoop Command

Use the snoop -d command to capture and inspect network packets. This command enables you to troubleshoot network problems at the packet level, allowing examination of the contents of a packet. The following shows example output for ce0.

```
# snoop -d ce0
Using device /dev/ce (promiscuous mode)
199.100.1.10 -> 199.100.1.11 TCP D=5100 S=59412  Ack=2577009842
Seq=391268307  Len=1460 Win=8760
199.100.1.10 -> 199.100.1.11 TCP D=5100 S=59412  Ack=2577009842
Seq=391269767 Len=1460 Win=8760
199.100.1.10 -> 199.100.1.11 TCP D=5100 S=59412  Ack=2577009842
Seq=391271227  Len=1460 Win=8760
```

In this example, if there were packets meant for hostname hs4-net11, but none showed in the output from the snoop command, you would know a problem existed. In that case, you would check your host file, network connect, or your ethernet switch setup. Refer to the snoop(1M) man page for more information.

Using the conf Option

Use the `nettr -conf` command to verify your trunking configuration.

```
# nettr -conf
Name    Head      Policy DEV Type   Original-Mac-Addr   Speed   Duplex    Link

 ce0   ce0          2         pci    8:0:20:8f:be:24      1000    Full      Up
 ce1   ce0                    pci    8:0:20:8f:be:24      1000    Full      Up
```

Make sure the ethernet switch software and the Sun Trunking 1.3 software are configured symmetrically. For example, both Sun Trunking and the switch should be configured with the same number of links per trunk.

Once you have configured Sun Trunking 1.3 software, be sure to re-configure your switch to match the trunking configuration.

Error Messages

See your console for error messages when configuring a Sun GigaSwift Ethernet adapter or a Sun Dual FastEthernet and Dual SCSI/P adapter for trunking. It is best to aggregate and unaggreate links on the console because error messages from the console and `nettr` are displayed inline.

Note – If you are configuring a Sun Gigabit Ethernet adapter or a Sun Quad FastEthernet adapter, error messages are returned by `nettr`, but may not appear in the console.

- If you try to configure a trunk that has already been configured, you will see the following error message from `nettr`:

```
# ./nettr -setup 0 device=ce members=0,1,2
./nettr: ioctl failed: Invalid argument
```

  A message similar to the following appears in the console stating that the aggregation already exists:

```
Jul  8 15:36:55 proboscis trslm: NOTICE: trunk(0): Aggregation
exists.
```

- If you try to configure a trunk member that is part of another aggregation, you will see the following message from `nettr`:

```
# ./nettr -setup 4 device=ce members=0,4
./nettr: ioctl failed: Invalid argument
```

A message similar to the following appears in the console stating that the aggregation already exists:

```
Jul  8 15:38:18 proboscis trslm: NOTICE: trunk link (ce0): device
instance in use on aggregation 0
```

- If you try to configure a non-existent member as part of an aggregation, `nettr` will fail as follows:

```
# ./nettr -setup 7 device=ce members=7,8
./nettr: ioctl failed: I/O error
```

A message similar to the following appears in the console stating that the aggregation already exists:

```
trslm: NOTICE: trunk link (ce7): DL_ERROR_ACK for DL_ATTACH_REQ(11),
errno 8, unix 0
```

- If the policy is set out of range, you will see an error message and trunk will be setup with default policy=1(MACSD).

```
proboscis#  nettr -setup 1 device=ce members=0,1,2,3 policy=7
Jul 10 17:40:04 trunk5-127 laggr: trunk(1) laggr_ioc: Policy 7 not
within supported range(1 - 4), Using default Policy 1
```

- If you plumb trunk member, you will see following message. The following example shows, an attempt to plumb ce2, which is already aggregated and is a trunk member. Plumbing is allowed only on the trunk-head.

```
proboscis#  ifconfig ce2 plumb
ifconfig: Jul 10 17:57:59 trunk5-127 ce: NOTICE: Illegal BIND to
trunk mbr
SIOCSLIFNAME for ip: ce2: no such interface
```

User Hints

- Aggregate and unaggregate from the console because error messages from the console and `nettr` are displayed inline.
- After aggregating the links, be sure that the head instance is plumbed using `ifconfig`.
- Remember that *only* IPv4 and IPv6 are unplumbed during `nettr -release` operation. You must unplumb all other VLANs and appplications running on the head instance manually.
- `netlbtest` in SunVTS fails when the links are aggregated. If you want to run `netlbtest` on an interface, unconfigure trunking on that interface.

Getting Help

If you cannot resolve the problems and you have a SunService contract, send the information gathered from these commands to your SunService representative. You must have the following information ready:

- Product name and release number (Sun Trunking 1.3)
- Model number of your machine
- Solaris release number

  Use the `showrev` command to display your operating system release:

```
% showrev
Hostname: proboscis-11
Hostid: 8081d6ca
Release: 5.9
Kernel architecture: sun4u
Application architecture: sparc
Hardware provider: Sun_Microsystems
```

APPENDIX **A**

Installing the Software Packages Manually

This appendix describes how to install the Sun Trunking 1.3 software and the driver software manually. This appendix includes the following sections:

■ “Installing the Driver Software” on page 41

Installing the Driver Software

You can install the packages from the Solaris release media for the installed version of the Solaris operating environment. However, if you are using the Solaris 7 or Solaris 8 operating environment with Gigabit Ethernet, GiagaSwift Ethernet, or Dual FastEthernet and Dual SCSI/P adapters, install the packages from the Trunking 1.3 CD-ROM. The packages on the Trunking 1.3 CD-ROM contain a pre-applied patch, so you will not need to install the required Solaris 7 or Solaris 8 patch for the driver after you install the driver packages from the Trunking 1.3 CD-ROM.

▼ To Install the Gigabit Ethernet Software for Solaris 7

1. **As superuser (root), change to the following directory:**

```
# cd media_path/Solaris_7/GigabitEthernet/Packages
```

Where:

media_path = `/cdrom/cdrom0`, if you are installing from the Trunking 1.3 CD-ROM

or

unzipped Trunking_1_3_path`/Trunking_1_3`, if you are installing from a download file.

2. **Install the packages as follows:**

```
# pkgadd -d . SUNWged SUNWgedm SUNWgedu
```

Answer `y` for package installation questions.

▼ To Install the GigaSwift Ethernet Software or Dual Fast Ethernet Software for Solaris 7 or Solaris 8

1. **As super-user (root), change directories as follows:**

```
# cd media_path/Solaris_x/GigaSwiftEthernet/Packages
```

Where *x* = 7 for Solaris 7, 8 for Solaris 8

Where:

media_path = `/cdrom/cdrom0`, if you are installing from the Trunking 1.3 CD-ROM

or

unzipped Trunking_1_3_path`/Trunking_1_3`, if you are installing from a download file.

2. **Install the packages:**

- For Solaris 7:

```
# pkgadd -d . SUNWced.u SUNWcedu SUNWcedx
```

- For Solaris 8:

```
# pkgadd -d . SUNWced.u SUNWcedu SUNWcedx SUNWvld SUNWvldu SUNWvldx
```

Answer y for package installation questions.

Verifying and Installing Driver Patches

Ensure that the latest patches are installed on your system.

- **Use the `showrev` command to see if the latest patches are currently installed.**

```
# showrev -p | grep patch-id
```

If the following patches (or more recent versions) are present, proceed with the Sun Trunking 1.3 software installation. If the patch version is less than indicated below, install the patches as described in the next section.

The patches are installed in the various product directories. The following patch versions (or higher) are required to support Trunking 1.3:

- GigaSwift Ethernet Driver
  - Solaris 7 112327-12
  - Solaris 8 111883-18 or 112119-02 if optional VLAN utility is installed.
  - Solaris 9 112817-10 or 114600-02 if optional VLAN utility is installed
- Gigabit Ethernet Driver
  - Solaris 7 106765-11
  - Solaris 8 108813-15
  - Solaris 9 113361-06
- Quad FastEthernet Driver
  - Solaris 7 107743-14
  - Solaris 8 108806-15
  - Solaris 9 112764-06

▼ To Install the Patches

1. **Change to the directory of the desired patch area:**

```
# cd media_path/Solaris_x/network_product/Patches
```

Where:

media_path = `/cdrom/cdrom0`, if you are installing from the Trunking 1.3 CD-ROM

or

unzipped Trunking_1_3_path`/Trunking_1_3`, if you are installing from a download file.

x = Solaris Version: 7, 8, or 9

network_product = GigaSwiftEthernet, GigabitEthernet, or QuadFast Ethernet

Install the required patch:

```
# patchadd patch_id
```

Where *patch_id* = See “Verifying and Installing Driver Patches” on page 44 for the patch list.

Installing the Trunking Software

Once the desired network Ethernet drivers are installed and updated, the Trunking packages can be installed.

▼ To Install the Trunking Packages

1. **Change to the directory of the Trunking packages:**

```
# cd media_path/Solaris_x//Trunking/Packages
```

Where:

media_path = `/cdrom/cdrom0`, if you are installing from the Trunking 1.3 CD-ROM

or

unzipped Trunking_1_3_path`/Trunking_1_3`, if you are installing from a download file.

x = Solaris Version: 7, 8, or 9

2. **Install the packages:**

```
# pkgadd -d . SUNWtrku SUNWtrkm
```

Answer `y` for package installation questions.